What is claimed is:

1. A radioactively labeled analog of a fatty acid that is taken up by mammalian tissue, comprising the formula:

$$R\text{-}(CH_2)_n\text{-}Z\text{-}(CH_2)_mCO_2H,$$

wherein n is 8-22, m is 0-10, R is a CH_3, aryl or a heterocyclic group, and Z is a cyclic or heterocyclic organic substituent which causes said analog to be metabolically trapped in said tissue.

2. The radioactively labeled analog of a fatty acid of claim 1, wherein said organic substituent is bonded to the fatty acid analog at the C2, C3; C3, C4; C4, C5; or C5, C6 positions.

3. The radioactively labeled analog of a fatty acid of claim 1, wherein said organic substituent causes said analog to be metabolically trapped in said tissue by permitting the occurrence of the first beta-oxidation step in which the carbon atom to which said substituent is bonded is beta to the carboxyl carbon atom, while preventing the cleaving off from said analog of the two carbon atoms to the right of the carbon atom to which said substituent is bonded.

4. The radioactively labeled analog of a fatty acid of claim 1, wherein said tissue is heart tissue.

5. The radioactively labeled analog of a fatty acid of claim 1, wherein said tissue is liver tissue.

6. The radioactively labeled analog of a fatty acid of claim 1, wherein said tissue is tumor tissue.

7. The radioactively labeled analog of a fatty acid of claim 1, wherein said analog emits detectable positrons after being taken up by said tissue.

8. The radioactively labeled analog of a fatty acid of claim 1, wherein said analog emits detectable photons after being taken up by said tissue.

9. The radioactively labeled analog of a fatty acid of claim 1, wherein the carbon chain of said fatty acid is saturated.

10. The radioactively labeled analog of a fatty acid of claim 1, wherein the carbon chain of said fatty acid is unsaturated.

11. The radioactively labeled analog of a fatty acid of claim 1, wherein said radioactive isotope comprises ^{18}F, ^{123}I, ^{131}I, ^{34m}Cl, ^{75}Br, ^{76}Br and ^{77}Br.

12. The radioactively labeled analog of a fatty acid of claim 1, wherein said cyclic organic substituent is a cyclic alkane.

13. The radioactively labeled analog of a fatty acid of claim 12, wherein said cyclic alkanes is selected from the group consisting of cyclopropyl, cyclobutyl and cyclopentyl.

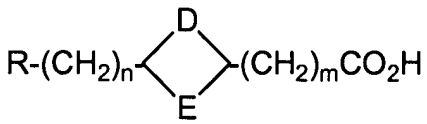
14. The radioactively labeled analog of a fatty acid of claim 1, wherein said heterocyclic organic substituent comprises a 3 to 5-membered heterocyclic ring structure.

15. The radioactively labeled analog of a fatty acid of claim 1, wherein said aryl group comprises a 5 to 7-membered ring structure.

16. The radioactively labeled analog of a fatty acid of claim 1, wherein said heterocyclic group comprises a 3 to 5-membered ring structure.

17. The radioactively labeled analog of a fatty acid of claim 11, wherein said radioactive isotope of a halogen is bonded to a carbon atom on the straight chain of said analog.

18. A radioactively labeled analog of a fatty acid that is taken up by mammalian tissue, comprising the formula:



wherein D is CH_2 or CH_2CH_2, E is CH_2 or CH_2CH_2, m is 0-10, n is 8-14 and R is CH_3, aryl or a heterocyclic group, wherein cyclic organic substituent -CDCE- causes said analog to be metabolically trapped in said tissue.

19. The radioactively labeled analog of a fatty acid of claim 18, wherein said organic substituent is bonded to the fatty acid analog at the C2, C3; C3, C4; C4, C5; or C5, C6 positions.

20. The radioactively labeled analog of a fatty acid of claim 18, wherein said organic substituent causes said analog to be metabolically trapped in said tissue by permitting the occurrence of the first beta-oxidation step in which the carbon atom to which said substituent is bonded is beta to the carboxyl carbon atom, while preventing the cleaving off from said analog of the two carbon atoms to the right of the carbon atom to which said substituent is bonded.

21. The radioactively labeled analog of a fatty acid of claim 18, wherein said tissue is heart tissue.

22. The radioactively labeled analog of a fatty acid of claim 18, wherein said tissue is liver tissue.

23. The radioactively labeled analog of a fatty acid of claim 18, wherein said tissue is tumor tissue.

24. The radioactively labeled analog of a fatty acid of claim 18, wherein said analog emits detectable positrons after being taken up by said tissue.

25. The radioactively labeled analog of a fatty acid of claim 18, wherein said analog emits detectable photons after being taken up by said tissue.

26. The radioactively labeled analog of a fatty acid of claim 18, wherein the carbon chain of said fatty acid is saturated.

27. The radioactively labeled analog of a fatty acid of claim 18, wherein the carbon chain of said fatty acid is unsaturated.

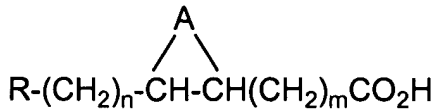
28. The radioactively labeled analog of a fatty acid of claim 18, wherein said aryl group comprises a 5 to 7-membered ring structure.

29. The radioactively labeled analog of a fatty acid of claim 18, wherein said heterocyclic group comprises a 3 to 5-membered ring structure.

30. The radioactively labeled analog of a fatty acid of claim 18, wherein said radioactive isotope comprises ^{18}F, ^{123}I, ^{131}I, ^{34m}Cl, ^{75}Br, ^{76}Br and ^{77}Br.

31. The radioactively labeled analog of a fatty acid of claim 30, wherein said radioactive isotope of a halogen is bonded to a carbon atom on the straight chain of said analog.

32. A radioactively labeled analog of a fatty acid that is taken up by mammalian tissue, comprising the formula:



wherein:

A = $(CH_2)_x$, O, S

x = 1, 2, 3, 4

cis and trans; R,R and S,S

m = 0-10

n = 14 - 8

R = ^{18}F-phenyl or ^{123}I-phenyl

and wherein the cyclic or heterocyclic organic substituent -CH-A-CH- causes said analog to be metabolically trapped in said tissue.

33. The radioactively labeled analog of a fatty acid of claim 32, wherein said organic substituent is bonded to the fatty acid analog at the C2, C3; C3, C4; C4, C5; or C5, C6 positions.

34. The radioactively labeled analog of a fatty acid of claim 32, wherein said organic substituent causes said analog to be metabolically trapped in said tissue by permitting the occurrence of the first beta-oxidation step in which the carbon atom to which said substituent is bonded is beta to the carboxyl carbon atom, while preventing the cleaving off from said analog of the two carbon atoms to the right of the carbon atom to which said substituent is bonded.

35. The radioactively labeled analog of a fatty acid of claim 32, wherein said tissue is heart tissue.

36. The radioactively labeled analog of a fatty acid of claim 32, wherein said tissue is liver tissue.

37. The radioactively labeled analog of a fatty acid of claim 32, wherein said tissue is tumor tissue.

38. The radioactively labeled analog of a fatty acid of claim 32, wherein said analog emits detectable positrons after being taken up by said tissue.

39. The radioactively labeled analog of a fatty acid of claim 32, wherein said analog emits detectable photons after being taken up by said tissue.

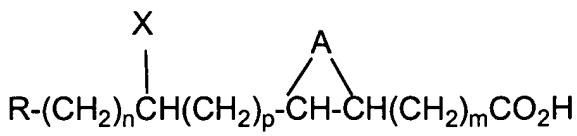
40. The radioactively labeled analog of a fatty acid of claim 32, wherein the carbon chain of said fatty acid is saturated.

41. The radioactively labeled analog of a fatty acid of claim 32, wherein the carbon chain of said fatty acid is unsaturated.

42. The radioactively labeled analog of a fatty acid of claim 32, wherein said radioactive isotope comprises ^{18}F, ^{123}I, ^{131}I, ^{34m}Cl, ^{75}Br, ^{76}Br or ^{77}Br.

43. The radioactively labeled analog of a fatty acid of claim 42, wherein said radioactive isotope of a halogen is bonded to a carbon atom on the straight chain of said analog.

44. A radioactively labeled analog of a fatty acid that is taken up by mammalian tissue, comprising the formula:



wherein:

A = $(CH_2)_y$, O, S
y = 1, 2, 3, 4
cis and trans; R,R and S,S
m = 0-10
n = 14 - 8
p = 0 - 6
R = CH_3
X = radioactive label

and wherein the cyclic or heterocyclic organic substituent -CH-A-CH- causes said analog to be metabolically trapped in said tissue.

45. The radioactively labeled analog of a fatty acid of claim 44, wherein said organic substituent is bonded to the fatty acid analog at the C2, C3; C3, C4; C4, C5; or C5, C6 positions.

46. The radioactively labeled analog of a fatty acid of claim 44, wherein said organic substituent causes said analog to be metabolically trapped in said tissue by permitting the occurrence of the first beta-oxidation step in which the carbon atom to which said substituent is bonded is beta to the carboxyl carbon atom, while preventing the cleaving off from said analog of the two carbon atoms to the right of the carbon atom to which said substituent is bonded.

47. The radioactively labeled analog of a fatty acid of claim 44, wherein said tissue is heart tissue.

48. The radioactively labeled analog of a fatty acid of claim 44, wherein said tissue is liver tissue.

49. The radioactively labeled analog of a fatty acid of claim 44, wherein said tissue is tumor tissue.

50. The radioactively labeled analog of a fatty acid of claim 44, wherein said analog emits detectable positrons after being taken up by said tissue.

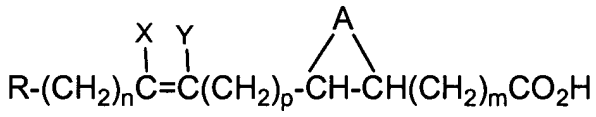
51. The radioactively labeled analog of a fatty acid of claim 44, wherein said analog emits detectable photons after being taken up by said tissue.

52. The radioactively labeled analog of a fatty acid of claim 44, wherein the carbon chain of said fatty acid is saturated.

53. The radioactively labeled analog of a fatty acid of claim 44, wherein the carbon chain of said fatty acid is unsaturated.

54. The radioactively labeled analog of a fatty acid of claim 44, wherein said radioactive isotope comprises ^{18}F, ^{123}I, ^{131}I, ^{34m}Cl, ^{75}Br, ^{76}Br or ^{77}Br.

55. A radioactively labeled analog of a fatty acid that is taken up by mammalian tissue, comprising the formula:



wherein: X = H, ^{18}F, ^{123}I, ^{131}I, ^{34m}Cl, ^{75}Br, ^{76}Br, ^{77}Br, and alkyl and heteroalkyls thereof,
Y = H, ^{18}F, ^{123}I, ^{131}I, ^{34m}Cl, ^{75}Br, ^{76}Br, ^{77}Br, and alkyl and heteroalkyls thereof,
A = $(CH_2)_z$, O or S
Z = 1-4,
m= 0-10,
n= 8-14,
p= 0-6,
R= CH_3, aryl or heterocyclic,

and wherein the cyclic or heterocyclic organic substituent -CH-A-CH- causes said analog to be metabolically trapped in said tissue.

56. The radioactively labeled analog of a fatty acid of claim 55, wherein said organic substituent is bonded to the fatty acid analog at the C2, C3; C3, C4; C4, C5; or C5, C6 positions.

57. The radioactively labeled analog of a fatty acid of claim 55, wherein said organic substituent causes said analog to be metabolically trapped in said tissue by permitting the occurrence of the first beta-oxidation step in which the carbon atom to which said substituent is bonded is beta to the carboxyl carbon atom, while preventing the cleaving off from said analog of the two carbon atoms to the right of the carbon atom to which said substituent is bonded.

58. The radioactively labeled analog of a fatty acid of claim 55, wherein said tissue is heart tissue.

59. The radioactively labeled analog of a fatty acid of claim 55, wherein said tissue is liver tissue.

60. The radioactively labeled analog of a fatty acid of claim 55, wherein said tissue is tumor tissue.

61. The radioactively labeled analog of a fatty acid of claim 55, wherein said analog emits detectable positrons after being taken up by said tissue.

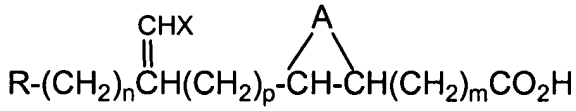
62. The radioactively labeled analog of a fatty acid of claim 55, wherein said analog emits detectable photons after being taken up by said tissue.

63. The radioactively labeled analog of a fatty acid of claim 55, wherein the carbon chain of said fatty acid is saturated.

64. The radioactively labeled analog of a fatty acid of claim 55, wherein the aryl group comprises a 5 to 7-membered ring structure.

65. The radioactively labeled analog of a fatty acid of claim 55, wherein the heterocyclic group comprises a 3 to 5-membered ring structure.

66. A radioactively labeled analog of a fatty acid that is taken up by mammalian tissue, comprising the formula:



wherein A = $(CH_2)_y$, O or S,

y = 1-4,

m = 0-10,

n = 8-14

p = 0-6,

R= CH_3, aryl or heterocyclic,

X = ^{18}F, ^{123}I, ^{131}I, ^{34m}Cl, ^{75}Br, ^{76}Br or ^{77}Br,

and wherein the cyclic or heterocyclic organic substituent -CH-A-CH- causes said analog to be metabolically trapped in said tissue.

67. The radioactively labeled analog of a fatty acid of claim 66, wherein said organic substituent is bonded to the fatty acid analog at the C2, C3; C3, C4; C4, C5; or C5, C6 positions.

68. The radioactively labeled analog of a fatty acid of claim 66, wherein said organic substituent causes said analog to be metabolically trapped in said tissue by permitting the occurrence of the first beta-oxidation step in which the carbon atom to which said

substituent is bonded is beta to the carboxyl carbon atom, while preventing the cleaving off from said analog of the two carbon atoms to the right of the carbon atom to which said substituent is bonded.

69. The radioactively labeled analog of a fatty acid of claim 66, wherein said tissue is heart tissue.

70. The radioactively labeled analog of a fatty acid of claim 66, wherein said tissue is liver tissue.

71. The radioactively labeled analog of a fatty acid of claim 66, wherein said tissue is tumor tissue.

72. The radioactively labeled analog of a fatty acid of claim 66, wherein said analog emits detectable positrons after being taken up by said tissue.

73. The radioactively labeled analog of a fatty acid of claim 66, wherein said analog emits detectable photons after being taken up by said tissue.

74. The radioactively labeled analog of a fatty acid of claim 66, wherein the carbon chain of said fatty acid is saturated.

75. The radioactively labeled analog of a fatty acid of claim 66, wherein the carbon chain of said fatty acid is unsaturated.

76. The radioactively labeled analog of a fatty acid of claim 66, wherein the aryl group comprises a 5 to 7-membered ring structure.

77. The radioactively labeled analog of a fatty acid of claim 66, wherein the heterocyclic group comprises a 3 to 5-membered ring structure.

78. A method of measuring blood flow in a subject comprising the following steps:
    a) localizing a detectable amount of a FA composition according to any one of claims 1, 18, 32, 44, 55, or 66, to a tissue of interest and;
    b) detecting a signal from said composition in a tissue of interest within about 1 second to about 10 minutes and;
    c) imaging a tissue of interest and;
    d) determining the rate of blood flow in a tissue of interest.

79. The method of claim 78, wherein the amount of said composition is 0.1 mCi to about 25 mCi.

80. The method of claim 78, wherein the amount of said composition is 1 mCi to about 5 mCi.

81. The method of claim 78, wherein said composition is detected within 1 minute to about 5 minutes after administration.

82. The method of claim 78, wherein said composition is administered with a second radioactive tracer.

83. The method of claim 82, wherein the second radioactive tracer is selected from the group consisting of ^{13}N-Ammonia, ^{57}Co-Cyanocobalamin, ^{59}Fe-Ferrous Citrate, ^{18}F-Fluorodeoxyglucose, ^{67}Ga-Gallium Citrate, ^{111}In-Indium Oxyquinoline, ^{111}In-Indium Pentetate, ^{111}In-Indium Pentetreotide, ^{111}In-Indium Satumomab Pendetide, Radioiodinated Iobenguane, ^{123}I-Iodohippurate Sodium, ^{131}I-Iodohippurate Sodium, ^{123}I-Iofetamine, ^{125}I-Iothalamate Sodium, ^{81}Krypton, ^{11}C-Methionine, RadioiodinatedAlbumin, ^{82}Rubidium, Sodium ^{51}Chromate, Sodium ^{18}Fluoride, Sodium ^{123}Iodide, Sodium ^{131}Iodide, Sodium ^{99m}–Pertechnetate, ^{99m}Tc-Albumin, ^{99m}Tc-Albumin (Aggregated), ^{99m}Tc-Albumin (Colloidal), ^{99m}Tc Arcitumomab, ^{99m}Tc-Bicisate, ^{99m}Tc-Disofenin, ^{99m}Tc-Exametazime, ^{99m}Tc-Gluceptate, ^{99m}Tc-Lidofenin, ^{99m}Tc-Mebrofenin, ^{99m}Tc-Medronate, ^{99m}Tc Mertiatide, ^{99m}Tc-Nofetumomab Merpentan, ^{99m}Tc-

Oxidronate, ^{99m}Tc-Pentetate, ^{99m}Tc-Pyrophosphate, ^{99m}Tc-(Pyro- and trimeta-) Phosphates, ^{99m}Tc Sestamibi, ^{99m}Tc Succimer, ^{99m}Tc-Sulfur (Colloidal), ^{99m}Tc-Teboroxime, ^{99m}Tc-Tetrofosmin, ^{201}Thallous Chloride, ^{127}Xenon and ^{133}Xenon.

84. The method of claim 78, wherein the tissue of interest is cardiac tissue.

85. The method of claim 78, wherein the cardiac tissue is diseased.

86. The method of claim 85, wherein the disease is selected from the group consisting of acute myocardial infarction, unstable angina, chronic ischemic heart disease, coronary artery disease, myocarditis, cardiomyopathies, congenital heart diseases, hypertensive heart disease, post-transplant heart disease, allograft vasculopathies, and valvular heart disease.

87. The method of claim 84, wherein the cardiac tissue is normal.

88. The method of claim 84, wherein the cardiac tissue is subjected to stress.

89. The method of claim 88, wherein the stress is induced by exercise.

90. The method of claim 88, wherein the stress is induced by pharmacological agents.

91. The method of claim 78, wherein the tissue of interest is not cardiac tissue.

92. The method of claim 91, wherein the tissue of interest is selected from the group consisting of brain, liver, bone, spleen, lung, blood, kidney, gastrointestinal, muscle, and adrenal tissue.

93. The method of claim 91, wherein the tissue is diseased.

94. The method of claim 91, wherein the tissue is normal.

95. The method of claim 93, wherein the disease is selected from the group consisting of abscess and infection; biliary tract blockage; blood volume studies; blood vessel diseases; blood vessel diseases of the brain; bone diseases; bone marrow diseases; brain diseases and tumors; cancer and neoplasms; colorectal disease; diabetes; disorders of iron metabolism and absorption; impaired flow of cerebrospinal fluid in brain; kidney diseases; lipid diseases; liver diseases; lung diseases; parathyroid diseases and/or parathyroid cancer; pernicious anemia and/or improper absorption of vitamin B_{12} from intestines; red blood cell diseases; salivary gland diseases; spleen diseases; stomach disorders and intestinal bleeding; tear duct blockage; thyroid diseases and/or thyroid cancer; urinary bladder diseases.

96. The method of claim 78, wherein the composition is detected by positron emission.

97. The method of claim 78, wherein the composition is detected by photon emission.

98. A method of measuring metabolism in a subject comprising the following steps:
    a) localizing a detectable amount of a FA composition according to any one of claims 1, 18, 32, 44, 55, and 66, to a tissue of interest and;
    b) detecting a signal from said composition in a tissue of interest within about 10 minutes to about 24 hours and;
    c) imaging a tissue of interest and;
    d) determining the rate of metabolism in a tissue of interest.

99. The method of claim 98, wherein the amount of the composition is 0.1 mCi to about 25 mCi.

100. The method of claim 98, wherein the amount of the composition is 1 mCi to about 5 mCi.

101. The method of claim 98, wherein said composition is detected within 30 minutes to about 120 minutes.

102. The method of claim 98, wherein said composition is administered with a second radioactive tracer.

103. The method of claim 102, wherein the second radioactive tracer is selected from the group consisting of ^{13}N-Ammonia, ^{57}Co-Cyanocobalamin, ^{59}Fe-Ferrous Citrate, ^{18}F-Fluorodeoxyglucose, ^{67}Ga-Gallium Citrate, ^{111}In-Indium Oxyquinoline, ^{111}In-Indium Pentetate, ^{111}In-Indium Pentetreotide, ^{111}In-Indium Satumomab Pendetide, Radioiodinated Iobenguane, ^{123} I-Iodohippurate Sodium, ^{131}I-Iodohippurate Sodium, ^{123} I-Iofetamine, ^{125}I-Iothalamate Sodium, ^{81}Krypton, ^{11}C-Methionine, RadioiodinatedAlbumin, ^{82}Rubidium, Sodium ^{51}Chromate, Sodium ^{18}Fluoride, Sodium ^{123}Iodide, Sodium ^{131}Iodide, Sodium ^{99m}–Pertechnetate, ^{99m} Tc-Albumin, ^{99m}Tc-Albumin (Aggregated), ^{99m} Tc-Albumin (Colloidal), ^{99m}Tc Arcitumomab, ^{99m} Tc-Bicisate, ^{99m} Tc-Disofenin, ^{99m} Tc-Exametazime, ^{99m} Tc-Gluceptate, ^{99m} Tc-Lidofenin, ^{99m} Tc-Mebrofenin, ^{99m} Tc-Medronate, ^{99m} Tc Mertiatide, ^{99m}Tc-Nofetumomab Merpentan, ^{99m} Tc-Oxidronate, ^{99m} Tc-Pentetate, ^{99m} Tc-Pyrophosphate, ^{99m} Tc-(Pyro- and trimeta-) Phosphates, ^{99m}Tc Sestamibi, ^{99m} Tc Succimer, ^{99m} Tc-Sulfur (Colloidal), ^{99m}Tc-Teboroxime, ^{99m}Tc-Tetrofosmin, ^{201}Thallous Chloride, ^{127}Xenon, and ^{133}Xenon.

104. The method of claim 98, wherein the tissue of interest is cardiac tissue.

105. The method of claim 105, wherein the cardiac tissue is diseased.

106. The method of claim 105, wherein the disease is selected from the group consisting of acute myocardial infarction, unstable angina, chronic ischemic heart disease, coronary artery disease, myocarditis, cardiomyopathies, congenital heart diseases, hypertensive heart disease, post-transplant heart disease, allograft vasculopathies, and valvular heart disease.

107. The method of claim 104, wherein the cardiac tissue is normal.

108. The method of claim 104, wherein the cardiac tissue is subjected to stress.

109. The method of claim 108, wherein the stress is induced by exercise.

110. The method of claim 108, wherein the stress is induced by pharmacological agents.

111. The method of claim 98, wherein the tissue of interest is not cardiac tissue.

112. The method of claim 111, wherein the tissue of interest is selected from the group consisting of brain, liver, bone, spleen, lung, blood, kidney, gastrointestinal, muscle, and adrenal tissue.

113. The method of claim 111, wherein the tissue is diseased.

114. The method of claim 111, wherein the tissue is normal.

115. The method of claim 113, wherein the disease is selected from the group consisting of abscess and infection; biliary tract blockage; blood volume studies; blood vessel diseases; blood vessel diseases of the brain; bone diseases; bone marrow diseases; brain diseases and tumors; cancer and neoplasms; colorectal disease; diabetes; disorders of iron metabolism and absorption; impaired flow of cerebrospinal fluid in brain; kidney diseases; lipid diseases; liver diseases; lung diseases; parathyroid diseases and/or parathyroid cancer; pernicious anemia and/or improper absorption of vitamin B_{12} from intestines; red blood cell diseases; salivary gland diseases; spleen diseases; stomach disorders and intestinal bleeding; tear duct blockage; thyroid diseases and/or thyroid cancer; and urinary bladder diseases.

116. The method of claim 98, wherein the composition is detected by positron emission.

117. The method of claim 98, wherein the composition is detected by photon emission.

118. The radioactively labeled analog of claim 3, wherein said organic substituent reduces metabolic dehydrogenation of said analog.

119. The radioactively labeled analog of claim 3, wherein said organic substituent reduces metabolic hydroxylation of said analog.

120. The radioactively labeled analog of claim 20, wherein said organic substituent reduces metabolic dehydrogenation of said analog.

121. The radioactively labeled analog of claim 20, wherein said organic substituent reduces metabolic hydroxylation of said analog.

122. The radioactively labeled analog of claim 34, wherein said organic substituent reduces metabolic dehydrogenation of said analog.

123. The radioactively labeled analog of claim 34, wherein said organic substituent reduces metabolic hydroxylation of said analog.

124. The radioactively labeled analog of claim 46, wherein said organic substituent reduces metabolic dehydrogenation of said analog.

125. The radioactively labeled analog of claim 46, wherein said organic substituent reduces metabolic hydroxylation of said analog.

126. The radioactively labeled analog of claim 57, wherein said organic substituent reduces metabolic dehydrogenation of said analog.

127. The radioactively labeled analog of claim 57, wherein said organic substituent reduces metabolic hydroxylation of said analog.

128. The radioactively labeled analog of claim 68, wherein said organic substituent reduces metabolic dehydrogenation of said analog.

129. The radioactively labeled analog of claim 68, wherein said organic substituent reduces metabolic hydroxylation of said analog.

130. A method of synthesizing a fatty acid according to any one of claims 1, 18, 32, 44, 55 and 66, comprising the steps of:

a. synthesizing a mono-protected primary alcohol from a starting compound;

b. adding a cyclic or heterocyclic organic substituent to the mono-protected primary alcohol to form a cyclic mono-protected primary alcohol; and

c. treating the cyclic mono-protected primary alcohol to form the fatty acid analog.

131. The method of claim 130, wherein the starting compound comprises a carbon backbone that is saturated.

132. The method of claim 130, wherein the starting compound comprises a carbon backbone that is unsaturated.

133. The method of claim 130, wherein the starting compound comprises a terminal phenyl group.

134. The method of claim 130, wherein the starting compound is a cyclic primary alcohol.

135. The method of claim 130, wherein the cyclic organic substituent is a cyclic alkane.

136. The method of claim 135, wherein the cyclic alkane is selected from the group consisting of cyclopropyl, cyclobutyl and cyclopentyl.

137. The method of claim 130, wherein said heterocyclic organic substituent comprises a 3-5-membered heterocyclic ring structure.

138. The method of claim 130, further comprising adding a radioactive label that is bonded to a carbon atom of the analog.

139. The method of claim 138, wherein the radioactive label is selected from the group consisting of: ^{18}F, ^{123}I, ^{131}I, ^{34m}Cl, ^{75}Br, ^{76}Br or ^{77}Br.

140. A kit for administration of a radioactively labeled analog of a fatty acid, comprising an analog of a fatty acid synthesized according to claim 130, a radioactive isotope, a pharmaceutically acceptable carrier, and optionally instructions for preparing the radioactively labeled analog or use thereof.

141. The kit of claim 140, wherein the radioactive isotope is selected from the group consisting of: ^{18}F, ^{123}I, ^{131}I, ^{34m}Cl, ^{75}Br, ^{76}Br or ^{77}Br.

142. The method of claim 78, further comprising the step of retaining the composition, or a metabolic derivative thereof, in the tissue by reducing transport and back-diffusion of the composition.

143. The method of claim 78, further comprising the step of retaining the composition, or a metabolic derivative thereof, in the tissue by reducing dehydrogenation of the composition.

144. The method of claim 78, further comprising the step of retaining the composition, or a metabolic derivative thereof, in the tissue by reducing hydroxylation of the composition.

145. The method of claim 78, further comprising the step of retaining the composition, or a metabolic derivative thereof, in the tissue by reducing ketoacyl formation of the composition.

146. The method of claim 78, further comprising the step of retaining the composition, or a metabolic derivative thereof, in the tissue by reducing ketoacetyl elimination of the composition.